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| APPLICATION NO.  | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.          | CONFIRMATION NO. |
|--|-------------|----------------------|------------------------------|------------------|
| 10/032,562   | 01/02/2002  | Shinichi Imai        | 740819-729                   | 5821             |
| 22204  | 7590        | 11/24/2003           |                              |                  |
| NIXON PEABODY, LLP<br>401 9TH STREET, NW<br>SUITE 900<br>WASHINGTON, DC 20004-2128 |             |                      | EXAMINER<br>RICHARDS, N DREW |                  |
|  |             |                      | ART UNIT<br>2815             | PAPER NUMBER     |

DATE MAILED: 11/24/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/032,562

Applicant(s)

IMAI, SHINICHI

Examiner

N. Drew Richards

Art Unit

2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 09 October 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) 2-9 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. §§ 119 and 120

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

Art Unit: 2815

## DETAILED ACTION

### *Claim Objections*

1. Claim 1 is objected to because of the following informalities: Claim 1 line 5 recites "fanning a plurality" where it should read "**forming** a plurality." Line 6 should include a comma after "by etching." Appropriate correction is required.

### *Claim Rejections - 35 USC § 103*

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Applicants admitted prior art in view of Jang (U.S. Patent No. 6,235,633 B1).

Applicant's admitted prior art (hereafter referred to as APA) teach a method for manufacturing a semiconductor device in figures 11A-11D. APA teaches:

(a) depositing an interlayer insulator film 3 on a substrate including a plurality of conductive layers 2 (figure 11A);

(b) forming a plurality of contact holes 7 running through the interlayer insulator film 3 to reach respective ones of the plurality of conductive layers 2 by etching, each of the contact holes 7 having a tapered portion at an upper end of the interlayer insulator film 3 and the intervals between the contact holes are irregular (figure 11B);

Art Unit: 2815

(c) depositing a conductive material film 8 on the interlayer insulator film so as to fill the plurality of contact holes (figure 11C); and

(d) removing the conductive material film 8 until a surface of the interlayer insulator film 3 is exposed so as to form a plurality of plugs 9 made of the conductive material film 8 filling the plurality of contact holes 7 (figure 11D).

APA does not teach (e) removing a portion of the interlayer insulator film, which has been exposed in step (d), so as to remove the tapered portions.

Jang teach a method of forming a semiconductor device including depositing an interlayer insulator 20,22, forming contact holes 2 in the interlayer insulator where the contact holes have a tapered portion at a top of the holes, depositing a conductive material 28 in the contact holes, and removing a portion of the conductive material to form plugs in the contact holes. Further, Jang teach claimed step (e) of removing a portion of the interlayer insulator film, which has been exposed in step (d), so as to remove the tapered portions. Jang teach this in a single CMP (chemical mechanical polishing) step that is considered a first step (removing the conductive material to expose layer 22) and a second step (removing layer 22 and thus tapered portions of the interlayer insulator). Jang teaches this process in figures 1-6.

APA and Jang are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to remove the tapered portions of the interlayer insulator film. The motivation for doing so is to prevent via-to-via shorts. Therefore, it would have been obvious to combine APA with Jang to obtain the invention of claim 1.

***Response to Arguments***

4. Applicant's arguments with respect to claim 1 have been considered but are moot in view of the new ground(s) of rejection. Any arguments that are deemed relevant to the newly presented rejection are not persuasive as discussed below.

Applicant's argument with regard to layer 22 of Jang not being a part of the interlayer insulator is not persuasive. Applicant argues that since layer 22 is a hard mask and it is not retained as an insulating film between the interconnect layers. This is not persuasive as layer 22 is considered part of the interlayer insulator. First, it being a hard mask is irrelevant. Second, the material is silicon dioxide which is a well known insulator. Layer 22 is between neighboring portions of the conductor when the conductor is formed and until layer 22 is etched, thus it is "interlayer" as it is between the layers horizontally. Also, layer 22 is between the conductor material 28 and conductive layers 18,16,14 the same was that the tapered portions of the "interlayer" insulator of the present invention are between the conductive material 8 and the conductive lines 2 as shown in figure 1C of the instant application. Further, the claims make no mention of interconnects and thus reading the layer being between interconnects is reading limitation from the specification into the claims that are not in the claims themselves.

Art Unit: 2815

***Conclusion***

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

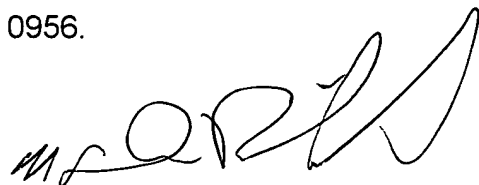
A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to N. Drew Richards whose telephone number is (703) 306-5946. The examiner can normally be reached on M-F 8:00-5:30; Every other Friday off.

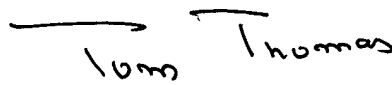
Art Unit: 2815

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone number for the organization where this application or proceeding is assigned is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



NDR



TOM THOMAS  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800